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ABSTRACT

A study investigated whether formal instruction in logic and syllogism construction helps English-as-a-Second-Language (ESL)/English-as-a-Foreign-Language (EFL) students in crafting argumentative essays. Subjects were 24 ESL students of varied linguistic backgrounds at the Mercer University (Georgia) English Language Institute. Half were given formal instruction in logic and syllogism construction. A multi-trait scoring procedure was used, testing formation of arguments and ideas, control of rhetorical features, and grammar control. Results indicate that instruction in logic and syllogism construction had a statistically significant positive effect on the writing scores given to those students who received instruction, as contrasted with those who did not receive the same instruction. (Contains 32 references.) (MSE)

The Logical Roots of Argumentative Writing: an Adjunct to Academic ESL/FL Writing Students?

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This study investigates whether formal instruction in logic and syllogism construction helps ESL students in crafting argumentative essays. Twenty-four ESL students at Mercer University English Language Institute in Atlanta took part in the study in which half of the students were given formal instruction in logic and syllogism construction. a multi-trait scoring procedure was used, testing formation of arguments and ideas, control of rhetorical features, as well as language (grammar) control. Results indicate that instruction in logic and syllogism construction resulted in a statistically significant positive difference in the writing scores given those students who received instruction as opposed to those who did not receive instruction.

Introduction

There is a great deal of information in the literature regarding problems that English for Academic Purposes students encounter when writing papers in the academic environment. Beginning with Kaplan (1966) and continuing with Connor (1996), Liebman (1992), Leki (1991), Leki (1992), Hinds (1990), and others, a significant amount of writing and research leads us to the view that rhetoric and "proper" rhetorical structure are culturally defined concepts which fall under the umbrella of the term "Contrastive Rhetoric." Writers in the social sciences have also made contributions to the understanding of dynamics involved in writing appropriate to the academic environment (argumentation, support for ideas, etc...) and cultural viewpoints (see Fay, 1994; Goody, 1986.) In the field of Applied Linguistics, we have been developing methods for dealing

with these differences by using the concept of Contrastive Rhetoric as a guide (Reid, 1993.)

While the literature is filled with information concerning differences in rhetorical styles, there is surprisingly little written regarding argumentation's root: logic, which can be viewed as the very cornerstone of scientific knowledge and academic inquiry in Western traditions (Jones, 1970.) The basic unit of scientific argument is the *syllogism*, in which two or more concrete premises are liked together to force a conclusion, which is produced by abstracting the result or consequences of the interaction of the premises. Aristotle is considered the father of Western logic an scientific discourse (Jones, 1970,) and thus it is fitting that we look to Aristotle for definition of the term "syllogism":

> *"Discourse in which, certain things being stated, something other than what is stated follows of necessity from their being so. I mean by the last phrase that they produce the consequence, and by this, that no further term is required from without to make the consequence necessary"* (Aristotle, in Stebbing, 1933.)

In the Western scientific and academic tradition, the syllogism -- in the form of an argument proof -- is the standard unit of coherence (Jones, 1970) in scientific and academic discourse. Coherence is defined by Richards, Platt & Platt (1992) as "the relationships which link the meaning of utterances or sentences"(p.61.) Given these premises, it would seem that the syllogism (i.e., Aristotelian logic) and coherence in Western academic discourse are intricately related, if not identical. The Applied Linguistics literature, however, shows no recent reference to logical cohesion and it's applicability to the L2 writing task, although some writers (see Reid, 1989; Reid, 1990; Connor and Farmer, 1990; Stewart, 1987) have made references to problems with logic and cohesion, as well as provided valuable ideas on how to overcome perceived

problems in writing. As far as problems in logical cohesion, there have been studies that might indicate some cause. Luria (1976) did an in-depth study of Islamic villagers in the former Soviet Union, whose consciousness had been shaped by forces different from the dominant culture. He found that these villagers tended to classify items differently, perceive deductive syllogisms differently, and preferred to use practical rather than theoretical methods in problem solving. Kaplan (1966) and Holloway (1981) did make direct reference to how differences in logical systems between cultures affected writing in English. None of the writers surveyed, however, mentioned any aspects of teaching Aristotelian logic as a possible solution to problems with coherence in Western academic writing. It might be hence inferred that there is an unconscious assumption in the minds of scholars in our field that the use of Aristotelian logic is universal, and therefore not an issue in academic ESL writing instruction. The author of this report decided to investige this question in order to determine if this possible assumption has merit.

Psychologically, there are two chief paradigms regarding logic in culture. The dominant paradigm is the Piagetian paradigm, which holds that abstract, syllogistic logic is a universal concept -- that individuals in all cultures who do not deviate significantly from the statistical mean with regard to intelligence, develop abstract, inferential logic, or "formal operations" via predictable stages of development. (Holloway, 1981) (Van Der Zanden, 1990.) Further, this formal logic is of an inferential nature, and is universally the same regardless of culture or linguistic background. Whorf (in Holloway, 1981) and Kaplan (1966), on the other hand, would point out that logic, or logical reasoning, evolves from culture, and is not universal (Holloway, 1981) (Kaplan, 1966.) Additionally, Holloway restates Whorf's belief that no "natural" logic exists, and further

implies that inferential logic might be the hallmark of industrialized Western cultures alone (Holloway, 1981). Holloway provides a middle ground on the issue, pointing out that "we are all capable of abstracting ideas, providing categories for groups of things and perceiving patterns, but we have culturally 'preferred' ways of abstracting, categorizing, and relating patterns" (Holloway, 1981, p. 21.) He further points out the difficulty in assessing how much these cognitive preferences influence language use and communication (Holloway, 1981.)

Some explanation of the anatomy of the syllogism, as well as other logical devices used by other cultures, is needed at this juncture. As Aristotle was in no small part concerned with science and mathematics, it is possible to understand how he understood the syllogism as mathematically derived: If A=B, and B=C, then it follows by abstract inference that A=C. Mathematically, this argument form is easily recognized by math students as an example of the transitive property. While this argument form is admittedly simple, and likely to be glossed over as "common sense," it can be argued that many ESL/EFL students from non-Western traditions of logic may not necessarily respond to the syllogism as a valid device in argumentation in writing because their native culture may require the use of devices other than the syllogism to support an argument. Fan Shen (1989) when describing the logic of the Chinese composition states:

> *"The straightforward approach to composition in English seemed to me, at first, illogical... I was unconsciously under the influence of a Chinese critical approach called the creation of 'yijing,' which is totally nonwestern... Roughly speaking, yijing is the process of creating a pictorial environment while reading a piece of literature"* (Fan Shen, 1989, p 463.)

Fan Shen then points to Chinese literary norms of using "pictorial logic" rather than Western "verbal logic" (Fan Shen, 1989 p. 465.) Kaplan (1966) states that Semitic languages rely on parallel constructions as a critical approach. Liebman (1992) reported one Arabic student as writing that "the best way to persuade someone was to support the ideas with something from the Qur'an because people believe that is the absolute truth" (Liebman, 1992, p. 155.) Virtanen (1995) studied perception of main point in L1 and L2 reading, and found that NS almost always agreed on the main point, which is derived by understanding the premises supporting it, while NNS often chose different points or premises which they regard as central to the text.

Students who proceed from alternate standards of logic will use those standard and strategies used in the L1 when writing in English unless they receive formal training in the strategies and standards of L2 discourse communities (Cumming, 1989.) Holloway points to a case in which a Japanese student wrote in a very associative, abstract manner. Her writing confused American readers, but Holloway suggests that " a Japanese student of equivalent ability in English had read it, I suspect that [s]he would not have had the problems that the American had (Holloway, 1981, p.3.) Holloway then eloquently describes ESL/FL teachers' reactions to such writing:

> *"Ideas don't follow one another logically, we don't see connections between events that the student seems to see. Whole links in chains of reasoning seem to be left out. We begin harping about 'transitions, use of examples and specifics,' and begin to wonder why logical categories so clear to us are so difficult to communicate, especially to our ... students" (Holloway, p.3.)*

Lindeberg (1984) further defines the problem by looking at irrelevancies in some student essays perceived as 'weak.' To Lindeberg, the main problem is teaching students

how to develop related thoughts or "functional units", and then develop the skills necessary to link them.

Given that the syllogism plays such a crucial role in framing the Western view of persuasion in science and academic inquiry, it is particularly puzzling why the syllogism is given little (if any) thought in pedagogical decisions regarding instruction of proper discussion formats -- rhetoric (oral and written) -- of science[1] and academic inquiry. In the field of ESL, a brief review of popular textbooks indicates that several reading and writing texts include short discussions of inductive and deductive logic, but none mention the word "syllogism." A reading text written by Phillips and Sotiriou (1996), for example, contains sections dealing with induction, deduction, allusion, connotation, qualification, and implication, but no mention of how these devices are constructed. This review of ESL textbook materials was admittedly too brief to allow much generalization regarding current standards in academic ESL/FL materials today, but there does appear to be a pattern of assumption that the syllogism is a universally acknowledged and understood device for coherence in writing. Certainly, a more comprehensive review of textbook materials is needed to provide the basis for a better generalization. The situation seems to be somewhat different if we look at writing texts aimed at L1 English writers, in which we sometimes see mention of the syllogism; one particularly good example can be found in Warriner (1982), where a comprehensive description of syllogisms and their applications to the academic writing task is presented. Again, this limited review of

[1] Mathematics is of course not to be included in this argument, as teachers of the mathematical sciences teach syllogisms as the basic properties of mathematics.

materials does not provide an adequate basis from which any substantial claims may be based. A much more comprehensive examination of texts is therefore required.

Reid (1989) states that the onus is on the student to recognize and fulfill the requirements of academic writing within a particular discourse community. Reid further recommends instruction in contrastive rhetoric to overcome the chasm in comprehension and production, but I believe that this top-down strategy only partially fills the gap. We must therefore look for other methods to help our students build their bridge. With this in mind, the question necessarily follows: could formal instruction in Aristotelian logic and construction of the syllogism improve logical cohesion and rhetorical control in academic ESL/FL writing?

Questions, Purpose, and Rationale of the Study

The central purpose if this study was to determine whether formal instruction in logic and syllogism construction would provide students with adjunct strategies for producing argumentative essays. In particular, the question was asked "Does formal instruction in syllogism construction affect the development of arguments and ideas, as well as control of rhetorical structures in persuasive writing"?

Some may argue that instruction in argumentative writing is not as important for EAP students as is instruction in other genres. In fact, it might be surprising to discover that there are relatively few instances where undergraduate students are required to write persuasive essays (Hale, Taylor, Bridgeman, Carson, Kroll, & Kantor, 1996). However, we should note that the typical English Composition course requires such writing, as do required state, provincial, and institutional writing examinations at some points in the

student's academic career. Additionally, it can be further argued that EAP students in graduate programs specifically need instruction in argumentative writing. While some other courses (logic and critical thinking for example) also require argumentative writing, the aforementioned writing situations are critical to the student's success, as those situations are typically used to serve gatekeeping roles. Additionally, Carrell and Connor (1991) indicate that persuasive writing as genre may be more difficult for students to organize and develop. For these reasons, argumentative writing was chosen as the locus of experimentation for this study.

Subjects

The subjects in this study were advanced level ESL students (n=24)[2] in an academic preparation course at the Mercer University English Language Institute in Atlanta. The students ranged in age from 19 to 35, and represent a wide variety of national origins: Korean (n = 5), Thai (n = 5), Japanese (n = 4), Chinese (n = 3), Central African (n = 2), Central and South American (n = 2), Greek (n = 1), and Indonesian (n = 1). Maintaining a heterogeneous mix of L1 origins in the classroom is considered important at Mercer, so the group had been split into two groups accordingly, hence, the groups -- although intact -- represented a nearly even mix of L1 backgrounds.

[2] The original population was 28, however, 4 students were absent from either the pre-test or the post-test. These samples were removed from the study.

Method

At the beginning of the study, a writing sample was taken from all subjects, in which they were asked to write an argumentative essay giving their arguments for or against providing birth control to teenagers. The subjects were explicitly instructed to give reasons for their opinion, and also to support their reasons with examples. Over the two weeks following this assignment, the experimental group was given four hours of instruction in argumentative logic, including instruction in:

- Understanding the structure of various types of syllogisms, (hypothetical, affirming the antecedent, denying the consequent)
- Constructing appropriate, functional syllogisms -- from conclusion to premises.
- Incorporating premises and conclusions into a 5 paragraph essay
- Supporting premises with examples and citations
- Balancing the premises with counter-premises (incorporating the opinions of others).

The study was designed in an X-T-X format for the experimental group, and an X-0-X design for the control group (see Hatch & Lazeraton, 1991). The experimental group was given four hours of instruction that replaced the normal instruction prescribed by Mercer University's writing curriculum. Both experimental and control groups received the same number of hours of instruction in writing. However, the control group received only the instruction prescribed by the writing curriculum. That is, they received instruction in making outlines, creating introductory, body, and conclusion paragraphs, and providing support for topic sentences and assertions. At the end of the two weeks, another writing sample was taken from the subjects. Both the experimental and control groups were

asked, again, to write an argumentative essay, giving their arguments and providing support for their opinions for or against capital punishment.

Statistical Procedures and Scoring

The study involved a one-tailed design, with a .05 alpha level. The null hypothesis for this study was the following: Instruction in formal logic and syllogism construction neither helps nor hinders students to write more coherent argumentative essays. The statistical procedure chosen was a repeated measures 2 (pre vs. post) x 2 ANOVA across the dimensions rated, with Scheffé post-hoc comparisons applied to the data. The data were derived from the scores given by 5 individual raters (three ESL teachers, one EFL teacher, and one university level English Composition teacher). Inter-rater reliability statistics were calculated using Pearson's product-moment correlations and Cronbach's Alpha. The raters were asked to score the essays on a five-point scale using a modified version of the *Michigan Writing Assessment Scoring Guide*, which measured the following dimensions:

- Development of Ideas and Arguments (IA)
- Control of Rhetorical Features (RC)
- Language Control (grammatical usage) (LC)

An additional category of "Sophistication and Style" was included in the rating, but was later dropped from analysis due to concerns about rater reliability. Modifications were made to the category of Ideas and Arguments to include the use of overt transition markers in scoring decisions. 7All essays were then typed (with corrections made only for spelling) for readers' ease of reading. For purposes of rater training, raters were given 4

essays which were removed from the study due to the students' absence from either the pre- or post-sample. These essays were pre-rated using the scale, and annotated with comments relevant to the scoring guide. The raters were also given a list of terms and definitions used in the scoring guide.

Results

Inter-Rater Reliability

The inter-rater reliability of this study was not as high as had been hoped. This is believed to be due to inadequate rater training, as well as the uneven distribution of the rating team (ESL vs. EFL and English Composition teachers). However, Inter-rater reliability using Cronbach's Alpha for the 5 raters was found to be as follows:

TABLE 1
Inter-rater reliability

Rated dimension	Cronbach's Alpha
Ideas and Arguments	.83
Rhetorical Features	.81
Language Control	.86

Statistical Results

A T-test was run on both experimental and control groups' pre-test results to insure that the groups were statistically similar on the tested dimensions at the outset of the study (Table 2). Raw means (Tables 3a, b &c) for the study indicate that the scores were distributed at or close to the median for the scoring range (6 points). Results of the

Repeated Measure ANOVA procedure (Table 4 shows that there were significant effects between groups in all of the dimensions as measured by the 5 raters. Table 4 shows that the differences were attributable to interactions between the groups caused by the instruction. As indicated in table 4, the interaction effect for Language Control was not found within the experimental group, but was rather an interaction between the control group pre-test score and the experimental group post-test scores, and thus not attributable to treatment.

Table 2
T-test for Group Similarity

Group	*n*	Mean	*s*	*t* value	*df*	*p*
IA - control	12	2.792	1.252	1.092	22	.05
IA - experimental	12	2.779	1.133			
RC - control	12	2.796	1.110	-1.166	22	.05
RC - experimental	12	2.808	1.096			
LC - control	12	2.446	.770	.0854	22	.05
LC - experimental	12	2.625	.923			

$t_{crit} = 2.074$

IA = Ideas and Arguments RC = Rhetorical Control LC = Language Control

Table 3a
Means Table by Ideas and Arguments (IA)

Group	n	IA Mean	IA Standard Deviation.	IA standard error
Control group pre-test	60	2.792	1.252	.162
Experimental group pre-test	60	2.779	1.133	.146
Control group post-test	60	3.025	1.157	.149
Experimental group post-test	60	3.413	.897	.116

Table 3b
Means Table by Rhetorical Control (RC)

Group	n	RC Mean	RC Standard Deviation	RC Standard Error
Control group pre-test	60	2.796	1.110	.143
Experimental group pre-test	60	2.808	1.096	.142
Control group post-test	60	2.917	.938	.121
Experimental group post-test	60	3.308	.815	.105

Table 3c
Means Table by Language Control (LC)

Group	n	LC mean	LC Standard Deviation	LC Standard Error
Control group pre-test	60	2.446	.770	.099
Experimental group pre-test	60	2.625	.923	.119
Control group post-test	60	2.683	.846	.109
Experimental group post-test	60	2.842	.845	.109

Table 3
Repeated Measures ANOVA

Dimension Measured	*df*	Sum of Squares	Mean Square	F-Value	P-Value
Ideas and Arguments	4	29.137	7.284	13.187	<.0001
Rhetorical Features	4	14.636	3.659	8.131	<.0001
Language Control	4	10.952	2.738	8.609	<.0001

Table 4
Scheffé Post-Hoc Comparison
Control Group vs. Experimental Group

Group	Mean Difference	Critical Difference	P-Value
Control IA	-.233	.402	.2539
Experimental IA	-.633	.402	.0021°
Control RC	-.121	.513	.5076
Experimental RC	-.500	.359	.0065°
Control LC	-.237	.305	.1263
Experimental LC	-.217	.305	.1630

° = significant at p<.05.
Comparisons in this table are not significant unless the corresponding p-value is less than .0083

IA = Arguments & Ideas RC= Control of Rhetorical Features LC = Language Control

Limitations of Study

There are several glaring limitations with regard to this study. First of all, the sample (n=24) of this pilot study is very small, and the representation of L1 backgrounds in the population is limited in scope as well. As subjects from mostly Asian L1 and cultural backgrounds were used in the study, it follows that additional studies should investigate the dynamics of instruction in formal logic within more varied (multiple L1 and cultural), as well as more specific (specific L1 and cultural) backgrounds. Secondly, inter-rater reliability is not as high as it could be, thus rater training -- as well as distribution of the raters -- needs to be more directly addressed in future studies. Another area of concern is that this study was conducted on intact groups of students rather than randomly selected groups of students. These factors combined tend to mitigate our

ability to generalize the results to other populations of ESL/EFL students. Follow-up studies thus must be conducted to verify the results of this study.

Discussion

The goal of this study was to see if instruction in formal logic and syllogism construction provided experimental condition students with enhanced skills needed to control and link ideas in an argumentative essay. As indicated by the results, the null hypothesis can be rejected with a fair amount of confidence at a reported $p<.0001$. Results indicate that students' control of rhetorical functions as perceived by the evaluators to be enhanced by instruction in formal logic and syllogism construction.

The lack of a significant effect with language control bears further study. We have seen that certain grammatical forms are inherent to and predominant within given contexts and genres (Biber, 1988) (Beaubien & Currie, 1995). Biber (1988), has investigated grammatical variation across discourse types, and has found specific grammatical features to be prominent in persuasive/argumentative discourse. Beaubien (1996) expounded upon this work with regard to argumentative writing. If indeed these suppositions bear fruit, we could then realize the possible benefits of incorporating aspects of this information in writing instruction. Among the grammatical features of argumentative writing are: modals, suasive verbs, conditional subordination, and infinitives (Biber, 1988). It might be possible that specific instruction in these areas could enhance the effect of instruction. A follow-up study with this possibility in mind is being planned.

Other issues to be investigated are the timing, amount, and pacing of instruction necessary to produce optimal results. The instruction of abstract logic necessitates the aquisition of abstract concepts and comprehension strategies in the L2, which may only be possible after certain developmental sequences in the L2 have been completed (Ellis, 1994). Attention must thus be paid to a wide range of issues, including:

- *what is the appropriate scope, depth and pacing of instruction of formal logic across the levels?*
- *how should instruction be formatted with respect to various L1 and cultural backgrounds?*
- *what are the moral implications of providing instruction in what might be considered "foreign" thinking?*
- *how can we guide the development and use of abstract language?*
- *how much time is required to acquire and incorporate a new system of organization?*
- *how do we incorporate formal instruction in grammatical forms inherent to argumentative writing (Biber, 1988)?*

As additional research is called for. It is suggested that a much larger sample of randomly assigned subjects be used, and that rater training and selection be carried out with more vigor. Replication studies on a larger scale, taking note of other issues raised, should be performed to be certain that the null hypothesis can once again be rejected. Should future studies bear out this supposition, then there may be cause to incorporate the instruction of syllogism construction into EAP writing pedagogy and curriculum design.

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